

# Mathematics Toolkit: Grade 7 Objective 4.B.1.a

Standard 4.0 Knowledge of Statistics

Topic B. Data Analysis

Indicator 1. Analyze data

Objective a. Recognize and analyze faulty interpretation or representation of data

Assessment Limits:

Use the choice of graphical display or the scale as leading to faulty interpretation or representation of data

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### Objective 4.B.1.a Tools

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### Scoring Rubric

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- Rubric - Brief Constructed Response

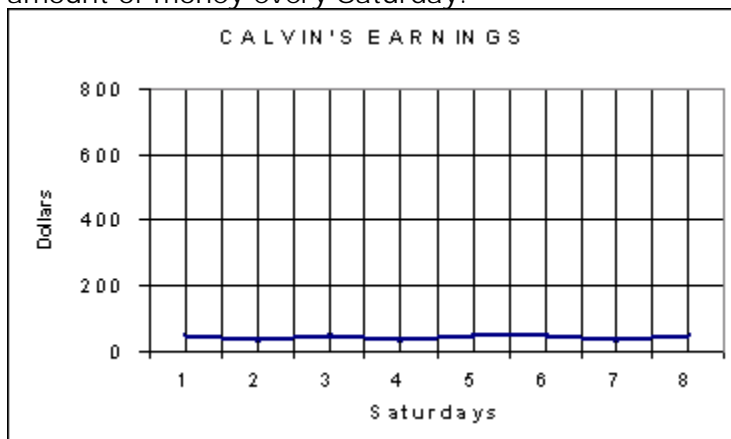
## Sample Item #1 Brief Constructed Response (BCR) Item with Annotated Student Responses

### Question

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, data, and/or symbols in your justification.

Step A is scored 0 (Incorrect) or 1 (Correct) and assesses 4.B.1.a.

Step B is scored with a 3 point (0, 1, 2) rubric and assesses Processes of Mathematics.

Note: Fourteen "Sample Student Responses" follow below. Each response appears on its own separate page and includes scoring information. The "Sample Student Responses" represent a range of score points.

### Correct Answer

#### Step A

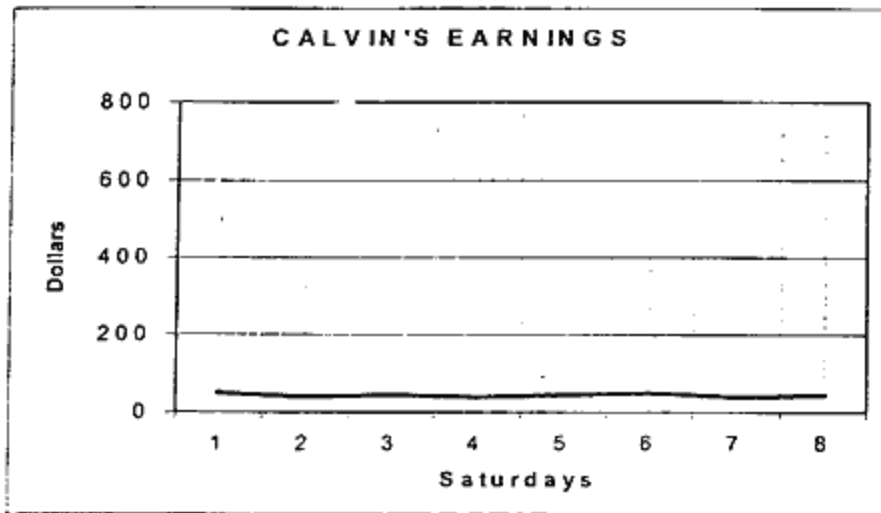
The vertical scale (or the y-axis).

### Annotated Student Responses

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

*The part of the line graph that is wrong is the X-axis*

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

*The X-axis leads to an incorrect interpretation of the graph because it doesn't increase when it is supposed to.*

Score for Sample Student Response #1:

Step A - Content (Knowledge of Statistics): 0

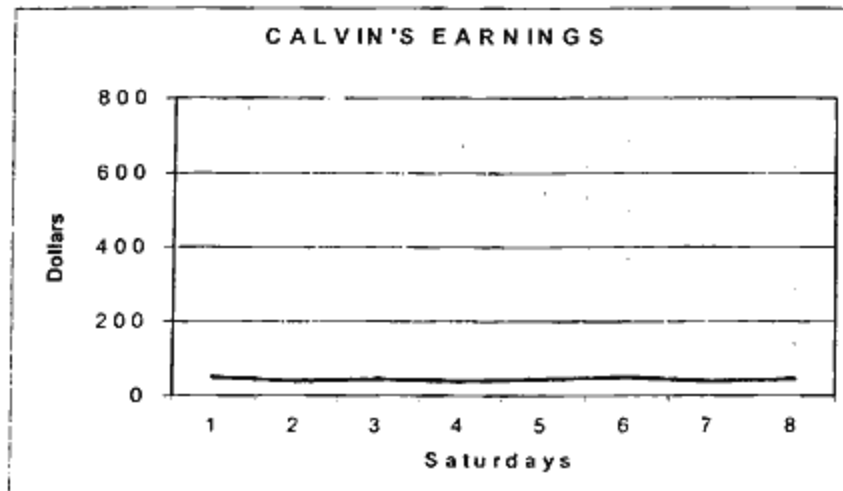
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: This response is irrelevant to the problem.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



#### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday? The straight line

#### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The straight line shows that Calvin got the same amount of money every Saturday

Score for Sample Student Response #2:

Step A - Content (Knowledge of Statistics): 0

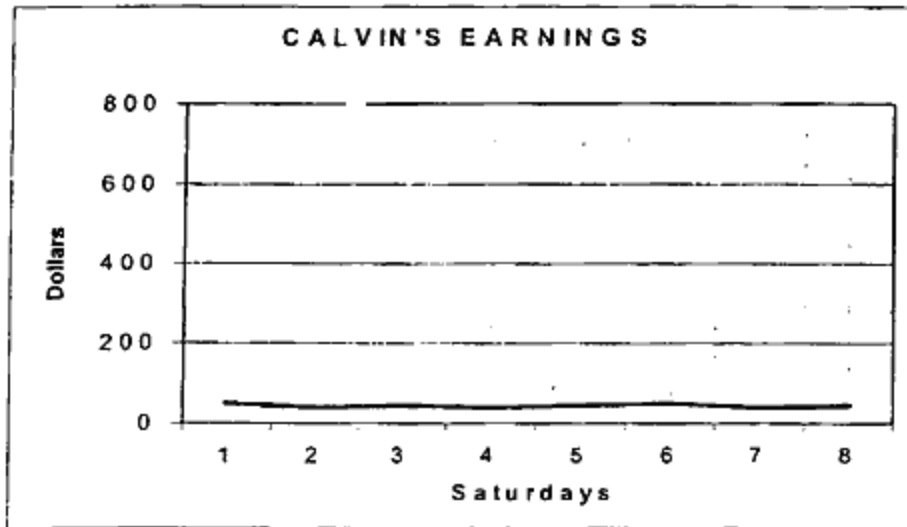
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: This response is completely incorrect.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The part where it starts with 200

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

A line graph should show change but this one doesn't

Score for Sample Student Response #3:

Step A - Content (Knowledge of Statistics): 1

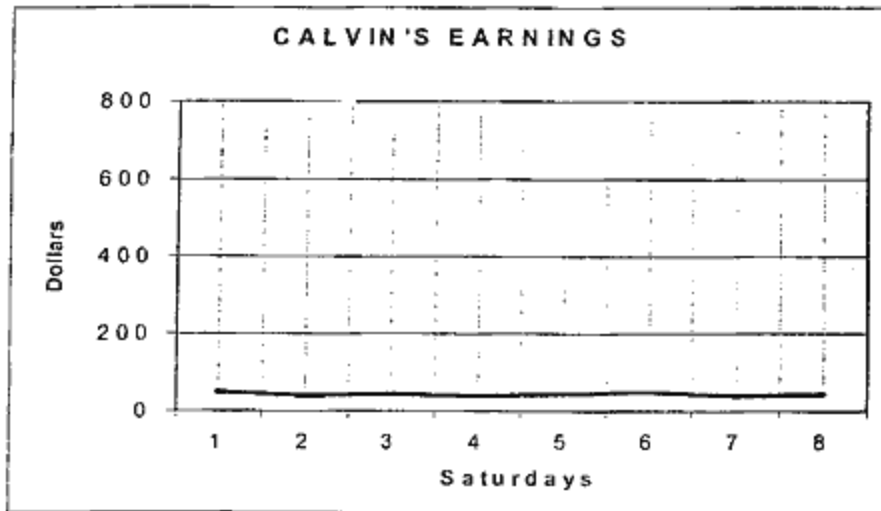
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: The response is irrelevant to the problem. The justification does not support the answer given in Step A.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



#### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

the intervals

#### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

I know this because the intervals are 200\$ apart. I also know this because he made less than 100\$ each trip.

Score for Sample Student Response #4:

Step A - Content (Knowledge of Statistics): 1

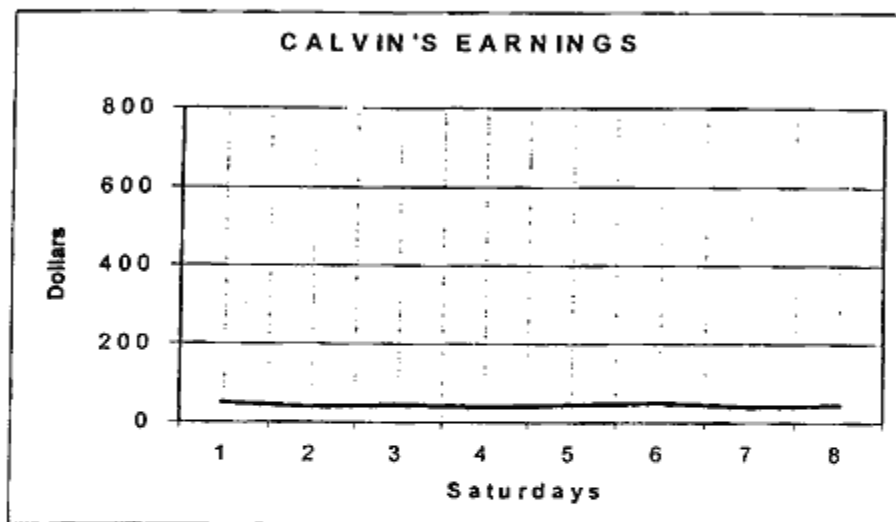
Step B - Processes of Mathematics: 1

Annotation for Step B, Using the Rubric: This response demonstrates a minimal understanding and analysis of the problem. The justification for why "the intervals" lead to an incorrect interpretation of the data is partially developed, "The intervals are 200\$ apart." Some supportive information is provided, "He made less then 100\$ each trip."

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The "y" axis

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The "y" axis is 200 which is too big and makes the earnings look small. The "y" axis should be about 10 or 15.

Score for Sample Student Response #5:

Step A - Content (Knowledge of Statistics): 1

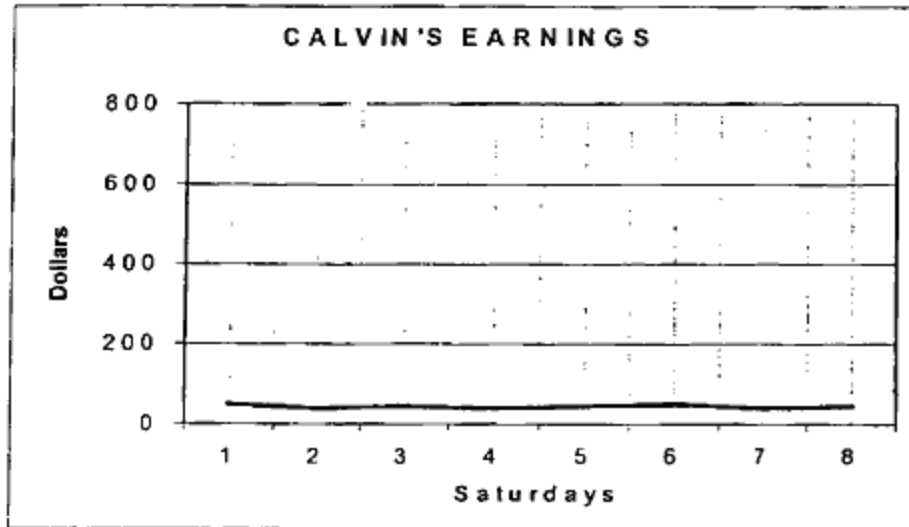
Step B - Processes of Mathematics: 1

Annotation for Step B, Using the Rubric: This response demonstrates a minimal understanding and analysis of the problem. The justification for why the "y-axis" leads to an incorrect interpretation of the data is partially developed, "[The scale] is 200 which is to big." Some supportive information is provided, "The "y" axis should be about 10 or 15."

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The scale or y-axis

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

If the scale goes up by high numbers, differences appear  
smaller which causes the line to barely rise.

Score for Sample Student Response #6:

Step A - Content (Knowledge of Statistics): 1

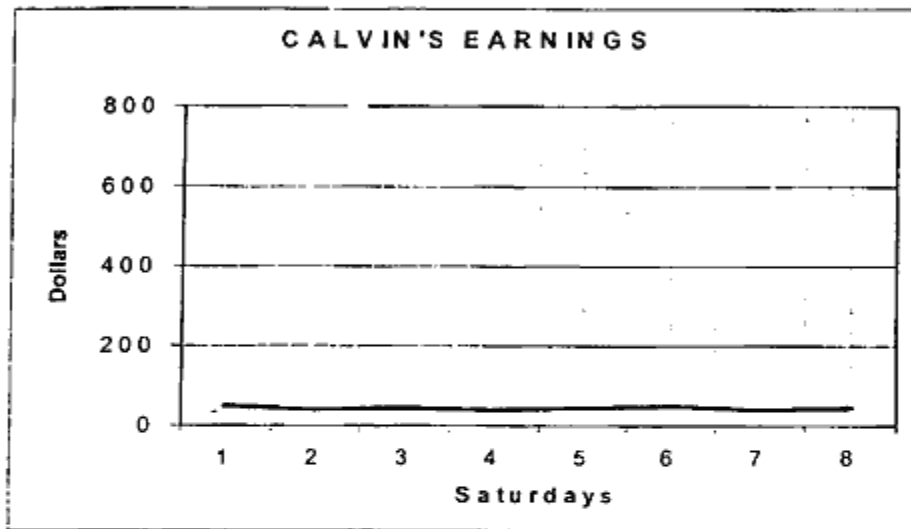
Step B - Processes of Mathematics: 2

Annotation for Step B, Using the Rubric: This response demonstrates a complete understanding and analysis of the problem. The justification for why the "scale of the y-axis" leads to an incorrect interpretation of the data is clear, developed and logical, "[This] causes the line to barely rise." Appropriate supportive information is provided, "If the scale goes up by high numbers, differences appear smaller."

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

the graph has very large intervals.

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The dollars he earns is going up by 200 dollars each interval so 45 dollars doesn't look a lot different from 50 dollars

Score for Sample Student Response #7:

Step A - Content (Knowledge of Statistics): 1

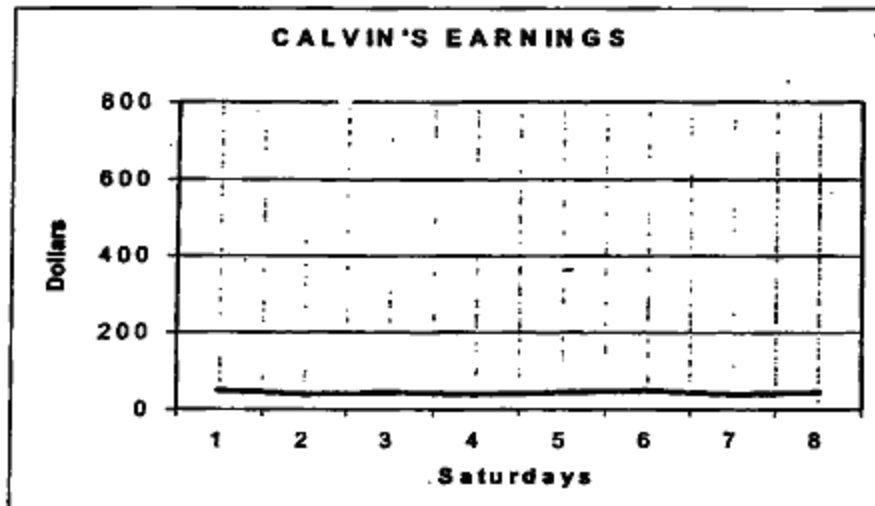
Step B - Processes of Mathematics: 2

Annotation for Step B, Using the Rubric: This response demonstrates a complete understanding and analysis of the problem. The justification for why the "large intervals" lead to an incorrect interpretation of the data is clear, developed, and logical, "45 dollars doesn't look a lot different from 50 dollars." Appropriate supportive information is provided, "[The y-axis is] going up by 200 dollars each interval."

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

Dollars

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The dollar side is incorrect because since it is up to \$50, then Calvin can change his line graph. I mean like he can count by 10's on the number side, so that it can be correct.

Score for Sample Student Response #8:

Step A - Content (Knowledge of Statistics): 1

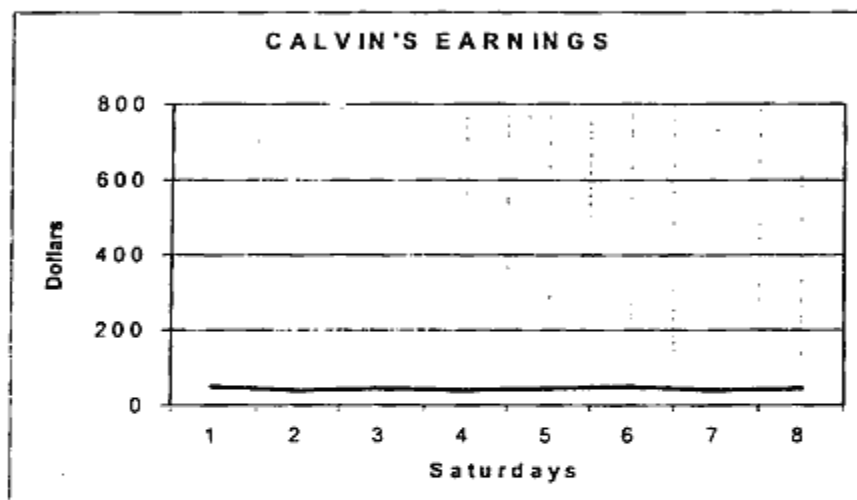
Step B - Processes of Mathematics: 1

Annotation for Step B, Using the Rubric: This response demonstrates a minimal understanding and analysis of the problem. The justification for why the "dollars" leads to an incorrect interpretation of the data is partially developed, "Since it [dollars earned] is up to \$50, then Calvin can change his line graph." Some supportive information is provided, "He can count by 10's." Compare to Sample Student Response #5.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



#### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The part would be in the beginning

#### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The beginning of the line graph is incorrect because  
the line didn't start at 0 and finish.

Score for Sample Student Response #9:

Step A - Content (Knowledge of Statistics): 0

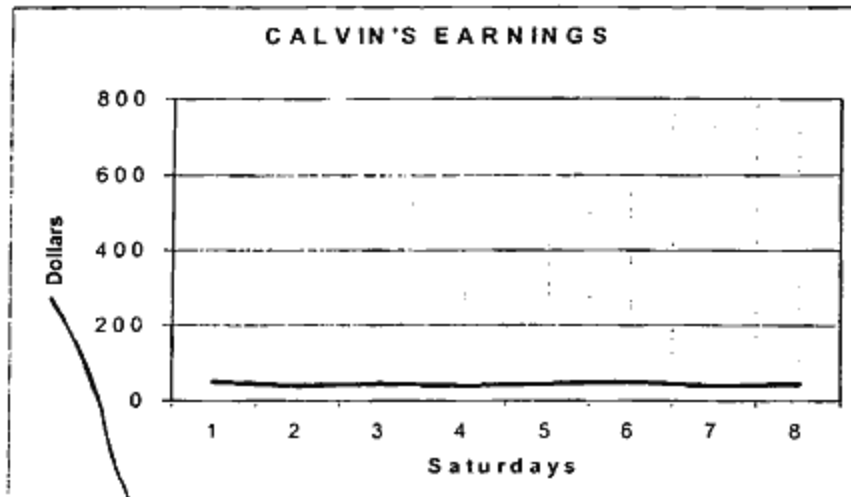
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: This response is irrelevant to the problem.  
Compare to Sample Student Response #1.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



Step A

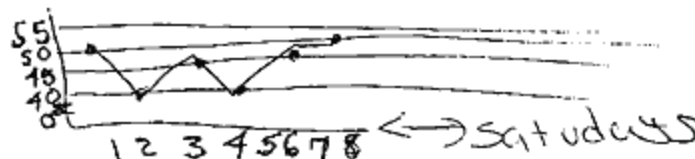
What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The left side the numbers are too high.

Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

instead of counting by 200 dollar  
they'd count by 50  
ex.



Score for Sample Student Response #10:

Step A - Content (Knowledge of Statistics): 1

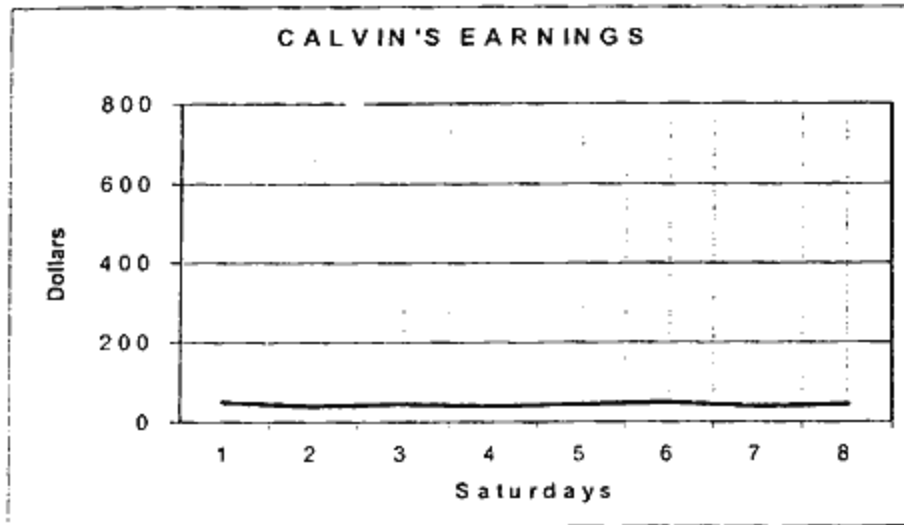
Step B - Processes of Mathematics: 2

Annotation for Step B, Using the Rubric: This response demonstrates a complete understanding and analysis of the problem. The justification for why the "left side" leads to an incorrect interpretation of the data is clear, developed and logical, "The numbers are too high." Supportive information is provided, "Instead of counting by 200 dollar... count by 5." The sample hand-drawn graph, with new intervals, also supports this justification. Compare to Sample Student Response #6.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The amount of dollars that Calvin collected is incorrect

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The dollars should go up.

Score for Sample Student Response #11:

Step A - Content (Knowledge of Statistics): 1

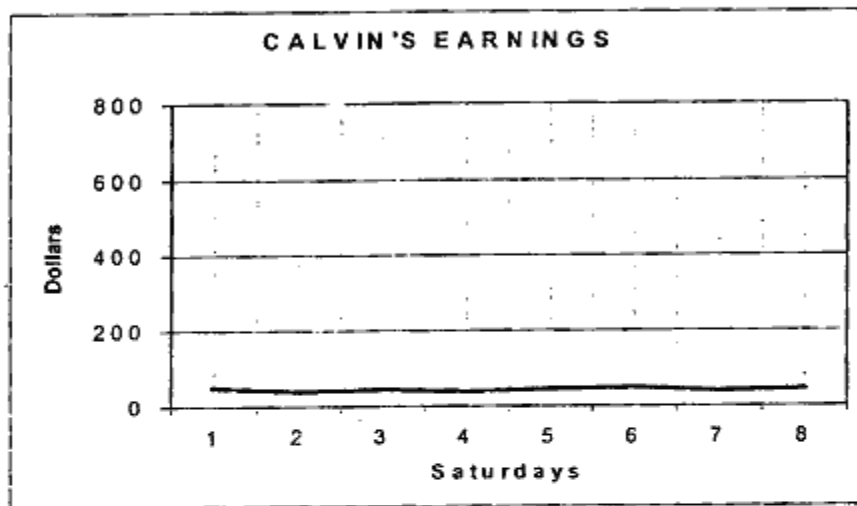
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: The response is irrelevant to the problem. The justification does not support the answer given in Step A. Compare to Sample Student Response #3.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



#### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The y axis's intervals are too big

#### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

If the y axis starts at 200  
and the highest number is 50, then it  
looks like he got the same amount,  
It's also because the only numbers are  
40, 45, and 50.

Score for Sample Student Response #12:

Step A - Content (Knowledge of Statistics): 1

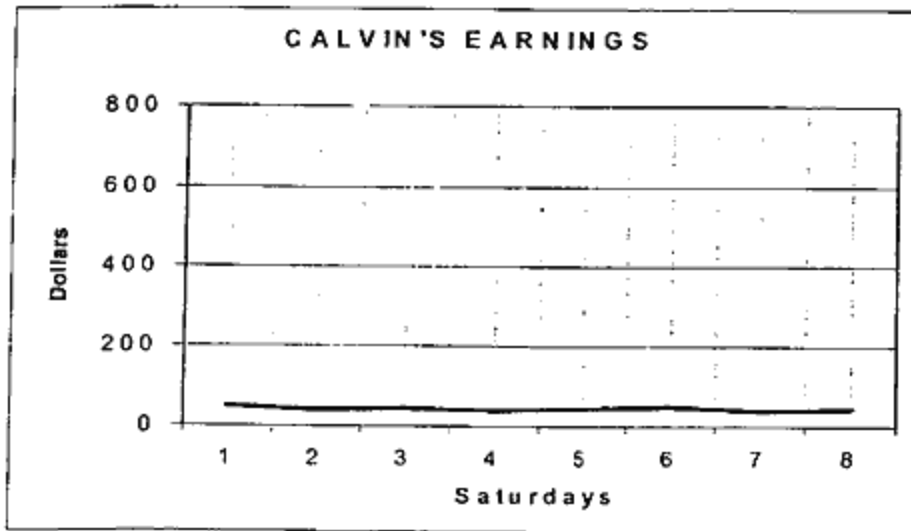
Step B - Processes of Mathematics: 2

Annotation for Step B, Using the Rubric: This response demonstrates a complete understanding and analysis of the problem. The justification for why the "intervals" lead to an incorrect interpretation of the data is clear, developed, and logical, "[They] are too big... it looks like he got the same amount." Appropriate supportive information is provided, "The y axis starts at 200... the highest number is 50... the only numbers are 40, 45, and 50." Compare to Sample Student Response #7.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



#### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The line goes straight

#### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The graph should go up because his earning increase.

Score for Sample Student Response #13:

Step A - Content (Knowledge of Statistics): 0

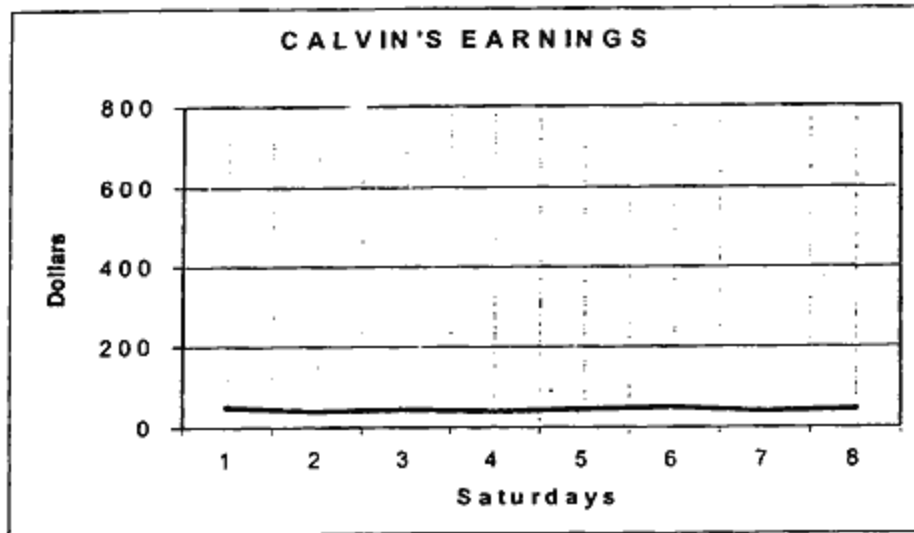
Step B - Processes of Mathematics: 0

Annotation for Step B, Using the Rubric: This response is completely incorrect. Compare to Sample Student Response #2.

Calvin mows his neighbors' lawns on Saturdays. The data below shows the amount of money that Calvin earned for the last 8 Saturdays.

Saturday	1	2	3	4	5	6	7	8
Dollars	50	40	45	40	45	50	40	45

The line graph below displays the data for Calvin's earnings. The way that the line graph was created leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday.



### Step A

What part of the line graph leads to an incorrect interpretation of the data that Calvin earned the same amount of money every Saturday?

The y axis is misleading

### Step B

Use what you know about line graphs to justify why the part of the graph you identified in Step A leads to an incorrect interpretation of the data. Use words, numbers, and/or symbols in your justification.

The numbers could go up by lower numbers.

Score for Sample Student Response #14:

Step A - Content (Knowledge of Statistics): 1

Step B - Processes of Mathematics: 1

Annotation for Step B, Using the Rubric: This response demonstrates a minimal understanding and analysis of the problem. The justification for why "y axes" lead to an incorrect interpretation of the data is partially developed, "The numbers could gone up by lower numbers." Supportive information and/or numbers are not provided. Compare to Sample Student Response #4.

## Rubric - Brief Constructed Response (BCR)

### Score 2

The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate.<sup>3</sup>

### Score 1

The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation<sup>1</sup> of and/or justification<sup>2</sup> for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.<sup>3</sup>

### Score 0

The response is completely incorrect, irrelevant to the problem, or missing.<sup>4</sup>

### Notes:

- <sup>1</sup> Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.
- <sup>2</sup> Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.
- <sup>3</sup> Students need to complete rubric criteria for explanation, justification, connections and/or extensions as cued for in a given problem.
- <sup>4</sup> Merely an exact copy or paraphrase of the problem will receive a score of "0".

Rubric Document Date: August 2003